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Measures low currents quickly, accurately, and economically

6485 Picoammeter



- **Cost-effective low current measurement solution**
- **10fA resolution**
- **5½-digit resolution**
- **<200µV burden voltage**
- **Up to 1000 readings/second**
- **Built-in Model 485 emulation mode**
- **IEEE-488 and RS-232 interfaces**
- **Analog output**

The 5½-digit Model 6485 Picoammeter combines Keithley's expertise in sensitive current measurement instrumentation with enhanced speed and a robust design. With eight current measurement ranges and high speed autoranging, this cost-effective instrument can measure currents from 20fA to 20mA, taking measurements at speeds up to 1000 readings per second.

The Model 6485's 10fA resolution and superior sensitivity make it well suited for characterizing low current phenomena, while its 20mA range lets it measure currents high enough for applications such as measuring 4-20mA sensor loops.

Although it employs the latest current measurement technology, it is significantly less expensive than other instruments that perform similar functions, such as optical power meters, competitive picoammeters, or user-designed solutions. With a price that's comparable to a general purpose DMM, the Model 6485 makes picoamp-level measurements affordable for virtually any laboratory or production floor.

Low Voltage Burden and Higher Accuracy

While DMMs typically employ shunt ammeter circuitry to measure current, the Model 6485 is a feedback picoammeter. This design reduces voltage burden by several orders of magnitude, resulting in a voltage burden of less than 200µV on the lower measurement ranges. The low voltage burden makes the Model 6485 function much more like an ideal ammeter than a DMM, so it can make current measurements with high accuracy, even in circuits with very low source voltages.

	Model 485	Model 6485
Current Ranges	2nA–2mA	2nA–20mA
Voltage Burden	200µV	200µV (1mV on 20mA range)
Reading Rate	3/s	1000/s
Digits	4½	5½
Analog Output	Yes	Yes
Battery Option	Yes	No
Storage Buffer	100 points	2500 points

Successor to the Model 485

The Model 6485 builds on the strengths of one of Keithley's most popular picoammeters, the Model 485, offering an additional 20mA measurement range, as well as much higher measurement speeds. With a top speed of up to 1000 readings per second, the Model 6485 is the fastest picoammeter Keithley has ever made. It offers ten times greater resolution than the Model 485 on every range. A time-stamped 2500-reading data buffer provides minimum, maximum, and standard deviation statistics. A built-in emulation mode simplifies upgrading existing applications originally configured with a Model 485. This emulation mode makes it possible to control the Model 6485 with any custom code written to control the Model 485. Refer to the comparison table for additional information.

When do you need a picoammeter?

Measuring low DC currents often demands a lot more than a digital multimeter (DMM) can deliver. Generally, DMMs lack the sensitivity required to measure currents less than 100nA. Even at higher currents, a DMM's input voltage drop (voltage burden) of hundreds of millivolts can make accurate current measurements impossible. Electrometers can measure low currents very accurately, but the circuitry needed to measure extremely low currents, combined with functions like voltage, resistance, and charge measurement, can increase an electrometer's cost significantly. The Model 6485 Picoammeter combines the economy and ease of use of a DMM with low current sensitivity near that of an electrometer.

LOW LEVEL MEASURE & SOURCE

6485

Picoammeter

Ordering Information

6485 Picoammeter

Accessories Supplied

CAP-18 Protective Shield/ Cap (2-lug)

4801 Low Noise BNC Input Cable, 1.2m (4 ft)

APPLICATIONS

- **Beam monitoring and radiation monitoring**
- **Leakage current testing in insulators, switches, relays, and other components**
- **SEM beam current measurements**
- **Galvanic coupling measurements**
- **Optoelectronic device testing and characterization**
- **Optical fiber alignment**
- **Circuit test and analysis in DCLF circuits**
- **Sensor characterization**
- **I-V measurements of semiconductors and other devices**
- **Nanoelectronic device characterization**
- **Capacitor leakage**
- **Teaching labs**

Features that Expand Test and Measurement Flexibility

- **Scaled voltage analog output.** This output allows the Model 6485 to transmit measurement results to devices like DMMs, data acquisition boards, oscilloscopes, or strip chart recorders.
- **220V overload protection.** This high overload protection and a robust design let the Model 6485 withstand abusive overflows.
- **One-touch front panel design.** Functions can be configured easily with the push of a button, without complicated function menus.
- **Built-in Trigger Link interface.** The Trigger Link interface simplifies synchronizing the Model 6485 with other instruments and voltage sources. This interface combines six independent selectable trigger lines on a single connector for simple, direct control over all instruments in a system.
- **RS-232 and IEEE-488 interfaces.** These interfaces make it easy to integrate the Model 6485 into automated test and measurement systems.
- **Display on/off switch.** For research on light-sensitive components, such as measuring the dark currents of photodiodes, the front panel display can be switched off to avoid introducing light that could significantly reduce the accuracy of the results.
- **REL and LOG functions.** The Model 6485 can make relative readings with respect to a baseline value or display the logarithm of the absolute value of the measured current.
- **Resistance calculations.** The Model 6485 can calculate resistance by dividing an externally sourced voltage value by the measured current.
- **Rear panel BNC inputs.** Inexpensive, easy-to-use BNC cables can be employed, rather than more expensive triax cables.

ACCESSORIES AVAILABLE

CABLES

4802-10	Low Noise BNC Input Cable, 3m (10 ft)
4803	Low Noise Cable Kit
7007-1	Shielded IEEE-488 Cable, 1m (3.3 ft)
7007-2	Shielded IEEE-488 Cable, 2m (6.6 ft)
7007-4	Shielded IEEE-488 Cable, 4m (13.1 ft)
7009-5	RS-232 Cable
7754-3	BNC to Alligator Cable, 0.9m (3 ft)
8607	Banana Cable set for Analog Output
8501-1	Trigger Link Cable with Male Micro-DIN Connectors at each End, 1m (3.3 ft)
8501-2	Trigger Link Cable with Male Micro-DIN Connectors at each End, 2m (6.6 ft)
8503	DIN-to-BNC Trigger Cable

ADAPTERS

CS-565	BNC Barrel
7078-TRX-BNC	Female BNC to 3-Slot Male Triax for connecting BNC cable into triax fixture

RACK MOUNT KITS

4288-1	Single Fixed Rack Mounting Kit
4288-2	Dual Fixed Rack Mounting Kit

GPIB INTERFACES

KPCI-488LPA	IEEE-488 Interface/Controller for the PCI Bus
KUSB-488B	IEEE-488 USB-to-GPIB Interface Adapter

SERVICES AVAILABLE

6485-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
C/6485-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase*

*Not available in all countries

Measures low currents quickly, accurately, and economically

LOW LEVEL MEASURE & SOURCE

6485 Picoammeter

Range	5½ Digit Default Resolution	Accuracy (1 Year) [1] ±(% rdg. + offset) 18°–28°C, 0–70% RH	Typical RMS Noise [2]	Analog Rise Time [3] (10% to 90%)
2 nA	10 fA	0.4 % + 400 fA	20 fA	8 ms
20 nA	100 fA	0.4 % + 1 pA	100 fA	8 ms
200 nA	1 pA	0.2 % + 10 pA	1 pA	500 µs
2 µA	10 pA	0.15% + 100 pA	10 pA	500 µs
20 µA	100 pA	0.1 % + 1 nA	100 pA	500 µs
200 µA	1 nA	0.1 % + 10 nA	1 nA	500 µs
2 mA	10 nA	0.1 % + 100 nA	10 nA	500 µs
20 mA	100 nA	0.1 % + 1 µA	100 nA	500 µs

TEMPERATURE COEFFICIENT: 0°–18°C & 28°–50°C. For each °C, add 0.1 × (% rdg + offset) to accuracy spec.

INPUT VOLTAGE BURDEN: <200µV on all ranges except <1mV on 20mA range.

MAXIMUM INPUT CAPACITANCE: Stable to 10nF on all nA ranges and 2µA range; 1µF on 20µA and 200µA ranges, and on mA ranges.

MAXIMUM COMMON MODE VOLTAGE: 42V.

MAXIMUM CONTINUOUS INPUT VOLTAGE: 220 VDC.

ISOLATION (Meter COMMON to chassis): Typically >5×10^{11}Ω in parallel with <1nF.

NMRR[1] (50 or 60Hz): 60dB.

ANALOG OUTPUT: Scaled voltage output (inverting 2V full scale on all ranges) 3% ±2mV, 1kΩ impedance.

NOTES

1. At 1 PLC – limited to 60 rdgs/second under this condition.
2. At 6 PLC, 1 standard deviation, 100 readings, filter off, capped input – limited to 10 rdgs/sec under this condition.
3. Measured at analog output with resistive load >100kΩ.

IEEE-488 BUS IMPLEMENTATION

MULTILINE COMMANDS: DCL, LLO, SDC, GET, GTL, UNT, UNL, SPE, SPD.

IMPLEMENTATION: SCPI (IEEE-488.2, SCPI-1996.0); DDC (IEEE-488.1).

UNILINE COMMANDS: IFC, REN, EOI, SRQ, ATN.

INTERFACE FUNCTIONS: SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E1.

PROGRAMMABLE PARAMETERS: Range, Zero Check, Zero Correct, EOI (DDC mode only), Trigger, Terminator (DDC mode only), Calibration (SCPI mode only), Display Format, SRQ, REL, Output Format, V-offset Cal.

ADDRESS MODES: TALK ONLY and ADDRESSABLE.

LANGUAGE EMULATION: Keithley Model 485 emulation via DDC mode.

RS-232 IMPLEMENTATION:

Supports: SCPI 1996.0.
Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k.
Protocols: Xon/Xoff, 7 or 8 bit ASCII, parity-odd/even/none.
Connector: DB-9 TXD/RXD/GND.

GENERAL

INPUT CONNECTOR: BNC on rear panel.

DISPLAY: 12 character vacuum fluorescent.

RANGING: Automatic or manual.

OVERRANGE INDICATION: Display reads "OVRFLOW."

CONVERSION TIME: Selectable 0.01 PLC to 60 PLC (50 PLC under 50Hz operation). (Adjustable from 200µs to 1s)

READING RATE:

To internal buffer: 1000 readings/second[1]
To IEEE-488 bus: 900 readings/second[1, 2]

Notes:
1. 0.01 PLC, digital filters off, front panel off, auto zero off.
2. Binary transfer mode. IEEE-488.1.

BUFFER: Stores up to 2500 readings.

PROGRAMS: Provide front panel access to IEEE address, choice of engineering units or scientific notation, and digital calibration.

EMC: Conforms with European Union Directive 89/336/EEC, EN61326-1.

SAFETY: Conforms with European Union Directive 73/23/EEC, EN61010-1.

TRIGGER LINE: Available, see manual for usage.

DIGITAL FILTER: Median and averaging (selectable from 2 to 100 readings).

ENVIRONMENT:

Operating: 0°–50°C; relative humidity 70% non-condensing, up to 35°C. Above 35°C, derate humidity by 3% for each °C.

Storage: –25° to +65°C.

WARM-UP: 1 hour to rated accuracy (see manual for recommended procedure).

POWER: 100–120V or 220–240V, 50–60Hz, 30VA.

PHYSICAL:

Case Dimensions: 90mm high × 214mm wide × 369mm deep (3½ in. × 8⅜ in. × 14⁹⁄₁₆ in.).

Working Dimensions: From front of case to rear including power cord and IEEE-488 connector: 394mm (15.5 in).

Net Weight: <2.8 kg (<6.1 lbs).

Shipping Weight: <5 kg (<11 lbs).

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